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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/885,319	06/19/2001	Mark A. Stan	1613370-0006	4594

7470 7590 01/29/2003

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[REDACTED] EXAMINER

MUTSCHLER, BRIAN L

[REDACTED] ART UNIT [REDACTED] PAPER NUMBER

1753

DATE MAILED: 01/29/2003

Please find below and/or attached an Office communication concerning this application or proceeding.



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7590 11/26/2002

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EXAMINER

MUTSCHLER, BRIAN L

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10

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Office Action Summary	Application No.	Applicant(s)	
	09/885,319	STAN ET AL.	
	Examiner Brian L. Mutschler	Art Unit 1753	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) Responsive to communication(s) filed on 22 October 2002.
- 2a) This action is FINAL. 2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) Claim(s) 1-37 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) Claim(s) _____ is/are allowed.
- 6) Claim(s) 1-37 is/are rejected.
- 7) Claim(s) _____ is/are objected to.
- 8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on _____ is/are: a) accepted or b) objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) The proposed drawing correction filed on _____ is: a) approved b) disapproved by the Examiner.
 If approved, corrected drawings are required in reply to this Office action.
- 12) The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 a) All b) Some * c) None of:
 1. Certified copies of the priority documents have been received.
 2. Certified copies of the priority documents have been received in Application No. _____.
 3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
 * See the attached detailed Office action for a list of the certified copies not received.
- 14) Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
 a) The translation of the foreign language provisional application has been received.
- 15) Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Comments

1. Applicant's cancellation of claims 6, 7, 14, 15, 24, 25, 35 and 36 is noted.
2. Applicant's statement regarding the priority statement and the oath/declaration is noted. The filing date of 60/212,552 is still shown to be 20 June 2002 in the Office database. Consequently, the objection to the statement of priority and to the oath/declaration is maintained in this action.
3. The objection to the specification has been overcome by Applicant's amendment.
4. The rejection of claims 2, 4, 8 and 11-37 under 35 U.S.C. 112, second paragraph, has been overcome by Applicant's amendment and in consideration of the response.
5. The rejection of claims 1-6, 8, 11-14, 16, 19-24, 27, 31-35 and 37 under 35 U.S.C. 102 over Ermer et al. has been overcome by Applicant's amendment. As Applicant notes, Ermer et al. do not disclose the use of phosphorous and arsenic dopants. The Amendment also overcomes the rejection of the remainder of the claims using Ermer et al. as the primary reference, for the same reason.

Priority

6. The filing date of the Provisional Application No. 60/212,552 provided by the Applicant, June 19, 2000, does not match the filing date of record in the Office, June 20, 2000. The priority statement in the specification should be changed to reflect the correct filing date, June 20, 2000.

Oath/Declaration

7. The filing date of Provisional Application No. 60/212,552 provided in the Declaration does not match Office records. A new Declaration should be submitted with the correct filing date: June 20, 2000.

Claim Rejections - 35 USC § 112

8. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

9. Claim 37 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 37 recites the limitation "upon completion of steps (a) through (g)" in line 3. This limitation is indefinite because there is no step (g). In claim 31, the last step is labeled (d).

Claim Rejections - 35 USC § 103

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

11. Claims 1-5, 8, 10-13, 16, 18-23, 27, 31-34 and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ermer et al. (U.S. Pat. No. 6,380,601) in view of Wiesmann (U.S. Pat. No. 4,634,605).

Ermer et al. disclose a multijunction solar cell having a germanium substrate **22** doped with an n-type dopant, a nucleation layer **34** comprised of indium gallium phosphide (InGaP), a second cell layer **36** of gallium arsenide (GaAs), and a third cell layer **44** of InGaP (col. 2, line 53 to col. 4, line 46). The nucleation layer **34** is formed at a preferred thickness of 25 Å to 500 Å and has a lattice parameter at a desired degree of lattice matching to the substrate **22** either "matched, or selectively made non-matching" (col. 3, lines 28-49). The solar cell of Ermer et al. would inherently absorb radiation ranging from UV radiation to a wavelength of 1800 nm through the use of Ge, GaAs and InGaP layers. Phosphorous is the preferred n-type dopant in the Ge substrate **22** (col. 3, line 1). The junction depth in the Ge substrate **22** ranges from 0.1 µm to 3 µm (col. 3, lines 7-10).

As subsequent layers are formed, the nucleation layer **34** would control the diffusion of dopant atoms into the substrate **22**. At the elevated temperatures at which the semiconductor layers are formed, solid state diffusion of dopants, such as arsenic from the GaAs layer **36**, would be controlled by the thickness of the nucleation layer **34**. Ermer et al. disclose "the invention allows for better passivation of the germanium homojunction substrate and shallower doping profiles with better control over diffused dopant concentrations" (col. 1, lines 63-66).

In addition to the method for forming the solar cell having the structure described above, Ermer et al. further disclose the use of metal-organic vapor phase epitaxy (MOVPE), which is also known as metal-organic chemical vapor deposition (MOCVD) (col. 4, line 67 to col. 5, line 1).

The method and apparatus of Ermer et al. differs from the instant invention because Ermer et al. do not disclose the following:

- a. The n-type dopants in the substrate include phosphorous and arsenic, as recited in claims 1, 11, 20 and 31;
- b. The use of arsenic as the n-type dopant, as recited in claims 7, 15, 25 and 36;
- c. A two-step diffusion profile, as recited in claims 9, 17 and 26; and
- d. One sun AM0 efficiencies in excess of 26%, as recited in claims 10 and 18.

Regarding claims 1, 11, 20 and 31, Wiesmann discloses the use of both arsenic and phosphorous in combination as an n-type dopant (col. 7, lines 21-25). The use of arsenic and phosphorous as n-type dopants is very well known in the art, and they are functional equivalents of each other.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the dopant in the device and method of Ermer et al. to use both phosphorous and arsenic as taught by Wiesmann because phosphorous and arsenic are functional equivalents.

Regarding claims 7, 15, 25 and 36, Ermer et al. disclose that "the germanium is typically made by doping the surface region of the germanium substrate with arsenic" (col. 1, lines 34-35).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the solar cell of Ermer et al. to use arsenic as the n-type dopant because using arsenic is well known to those skilled in the art.

Regarding claims 10 and 18, the object of all solar cells made is to have the highest possible efficiency. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the solar cell of Ermer et al. to have the highest efficiency possible because maximizing the efficiency of solar cells uses the available energy in the best way possible.

12. Claims 9, 17 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ermer et al. (U.S. Pat. No. 6,380,601) in view of Wiesmann (U.S. Pat. No. 4,634,605), as applied above to claims 1-5, 8, 10-13, 16, 18-23, 27, 31-34 and 37, and further in view of Stanbery (U.S. Pat. No. 4,322,571).

Ermer et al. and Wiesmann describe a method and device having all of the limitations recited in claims 1-5, 8, 10-13, 16, 18-23, 27, 31-34 and 37, as explained above in section 11. Furthermore, Ermer et al. disclose the use of a dopant gradient in the substrate (col. 3, lines 10-13).

The method and device described by Ermer et al. and Wiesmann differs from the instant invention because Ermer et al. and Wiesmann do not disclose the formation of a two-step diffusion profile in the substrate.

Stanbery discloses a method for forming a solar cell with a two-step diffusion profile. The solar cell has areas with a deep junction, which has a high thermal stability, an areas of shallow junctions, which have high light-to-electrical energy conversion efficiencies (col. 5, lines 64-68).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the solar cell of Ermer et al. and Wiesmann to use a two-step diffusion profile as taught by Stanbery because the two-step diffusion profile has high thermal stability and a high conversion efficiency.

13. Claims 28, 29 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ermer et al. (U.S. Pat. No. 6,380,601) in view of Wiesmann (U.S. Pat. No. 4,634,605), as applied above to claims 1-5, 8, 10-13, 16, 18-23, 27, 31-34 and 37, and further in view of Gibbons (U.S. Pat. No. 4,001,864).

Ermer et al. and Wiesmann describe a method and apparatus having all of the limitations recited in claims 1-5, 8, 10-13, 16, 18-23, 27, 31-34 and 37, as explained above in section 11.

The method and apparatus described by Ermer et al. and Wiesmann differs from the instant invention because they do not disclose the method or source of diffusion of dopant atoms into the substrate.

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Regarding claims 28 and 29, at the temperatures used for the deposition of the upper cell layers, solid state diffusion of phosphorous atoms from the InGaP nucleation layer **34** to the substrate **22** would occur.

Gibbons discloses a method for fabricating solar cells wherein solid state diffusion is used to redistribute impurities to create efficient pn junctions (col. 10, line 13).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method described by Ermer et al. and Wiesmann to use solid state diffusion using the nucleation layer as the source of dopant atoms because Gibbons teaches that solid state diffusion can be used to redistribute dopant atoms and

Regarding claim 30, gas phase diffusion is a conventional technique for supplying a dopant to a semiconductor layer.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method described by Ermer et al. and Wiesmann to diffuse the dopant atoms by gas phase diffusion because gas phase diffusion is a common and efficient method for diffusing dopant atoms into semiconductor layers.

Response to Arguments

14. Applicant's arguments with respect to claims 1-37 have been considered but are moot in view of the new ground(s) of rejection.
15. Regarding claims 1-37, Applicant has argues that Ermer et al. do not disclose the use of arsenic and phosphorous together as an n-type dopant (see page 6 of Applicants response).
16. As explained above, Wiesmann teaches the use of arsenic and phosphorous in combination with each other. The use of these dopants is very well in the art and they are known to function equivalently. Although Ermer et al. do not disclose the use of arsenic as an n-type dopant, it would have been reasonable for one skilled in the art to use equivalent materials such as arsenic and phosphorous. Furthermore, based on the teaching of Wiesmann, it would have been obvious that a combination of the two materials functions in the same way as the individual materials.

Conclusion

17. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not

mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Brian L. Mutschler whose telephone number is (703) 305-0180. The examiner can normally be reached on Monday-Friday from 8:00am to 4:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on (703) 308-3322. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9310 for regular communications and (703) 872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.


NAM NGUYEN

SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700

blm
November 19, 2002